



RCA INSTITUTES

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Technical Lesson 44

VICTOR MICRO-SYNCHRONOUS RADIO R-32 R-52 RE-45 and RE-75

The Victor Micro-Synchronous set is a power operated tuned radio-frequency receiver of the antenna type, employing an antenna coupling stage and four stages of tuned and neutralized radio-frequency amplification, a detector, a first stage audio, and a power stage of push pull amplification.

A high degree of sensitivity is made possible by means of a system of micro-meter adjustments on the tuning condensers, permitting precision automatic alignment or synchronization of the tuned radio-frequency stages throughout the entire tuning range at all times. Each set of condensers is thus properly aligned at the factory and locked into position. A new method of stabilizing the radio-frequency circuit permits a high degree of selectivity without causing any decrease in sensitivity.

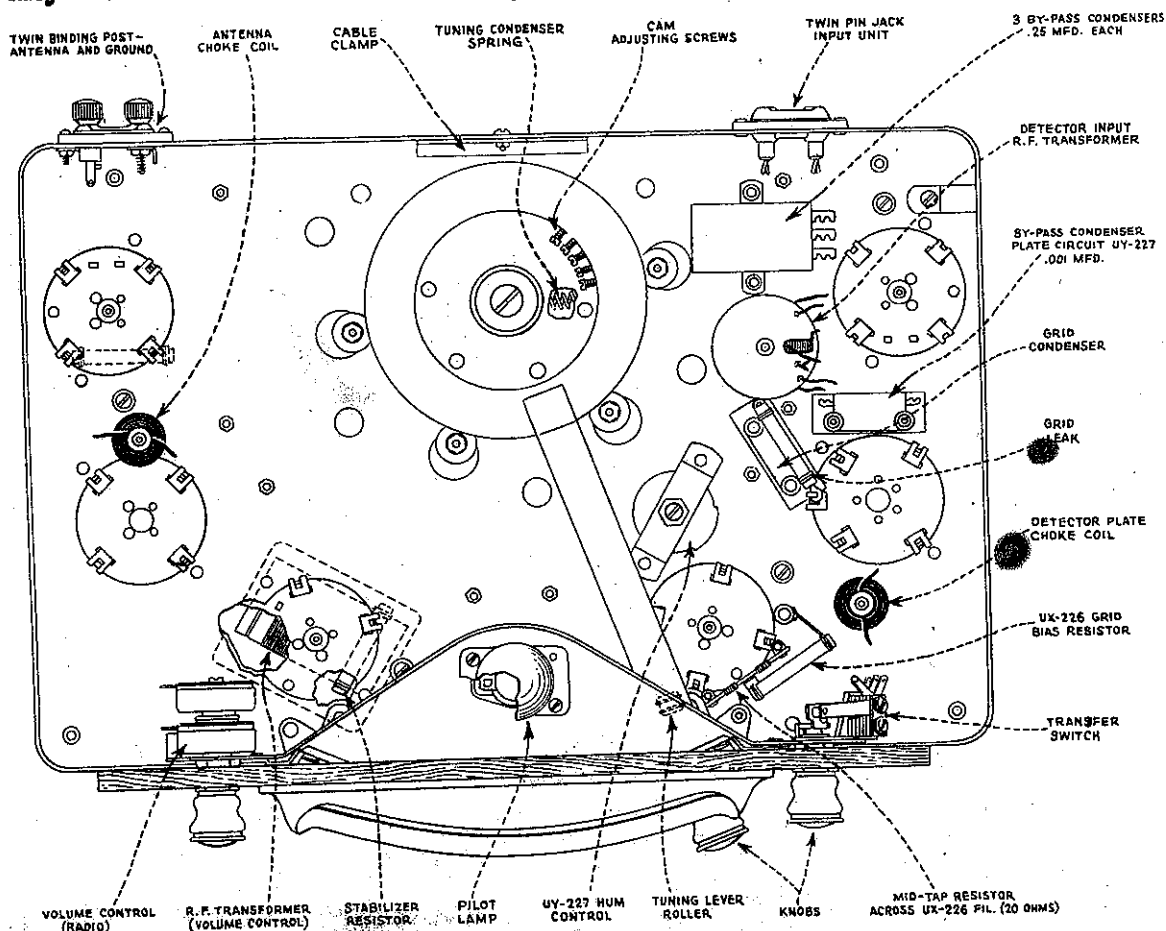
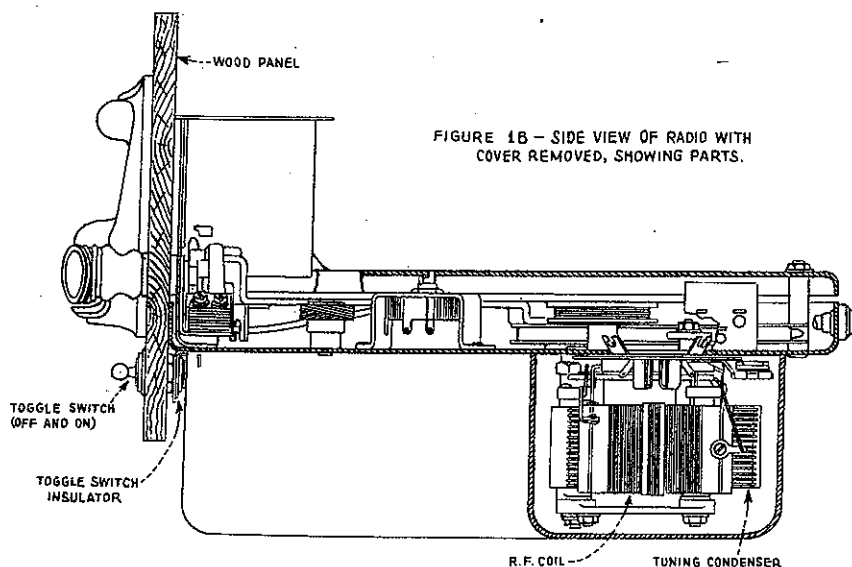


FIGURE 1A—TOP VIEW OF RADIO WITH COVER REMOVED, SHOWING PARTS.

The instrument comprises three standard units as follows:

- (1) Radio, in which are contained the r-f stages and the detector;
- (2) Power Amplifier, containing the first audio, the power stage of push pull amplification, and the rectifier;
- (3) Electro-dynamic Reproducer. The units are so designed that all parts are readily accessible for servicing.

Six vacuum tubes UX-226 are used in the r-f and first audio amplifier stages, a UY-227 detector, and two UX-245 in the power stage. The UX-280 is used as a rectifier.



The Victor radio is designed for operation on 105 to 120 volts, 50 to 60 cycles, alternating current. Special equipment is available for operation on 105 to 120 volts, 25 to 40 cycles. The power consumption when operating the radio is approximately 105 watts, and approximately 160 watts when operating the Electrola.

Figures 1A and 1B show top and side views, respectively, of radio with cover removed. Figure 2 is a top view of the power amplifier unit, and Figure 3 is a bottom view of the power amplifier unit.

INSTALLATION

Antenna. For best average sensitivity and selectivity the antenna should be from 50 to 75 feet long including the lead-in and ground wires, and should be as high above ground as possible. A short antenna tends to decrease the sensitivity and increase the selectivity whereas a long antenna tends to increase the sensitivity and decrease the selectivity. For local reception sufficient sensitivity can usually be obtained except in shielded locations by using a five or six foot length of wire as an antenna.

Ground. A good ground connection is highly important for the proper operation of the instrument and must be used at all times. The connection should be made to a well scraped and cleaned portion of a water pipe by clamping with

a ground clamp. If such a connection is not available, a pipe or metal rod may be driven three or four feet into the ground, preferably where the soil is moist. Attention is called to the fact that a spark may be produced if the ground is connected to the instrument while the power plug is attached. This condition, which is caused by the condenser discharge from the power line, is quite normal and will cause no harm to the instrument.

Power Line Voltage. The power line voltage should be measured with an a-c voltmeter at the time of installation. If the voltage is above 125 volts, a tapped resistor should be connected in series with one side of the power line and the resistance varied until input voltage at the instrument is 115 volts. If the voltage fluctuates badly, the co-operation of the power company should be secured, and an attempt made to eliminate such fluctuation.

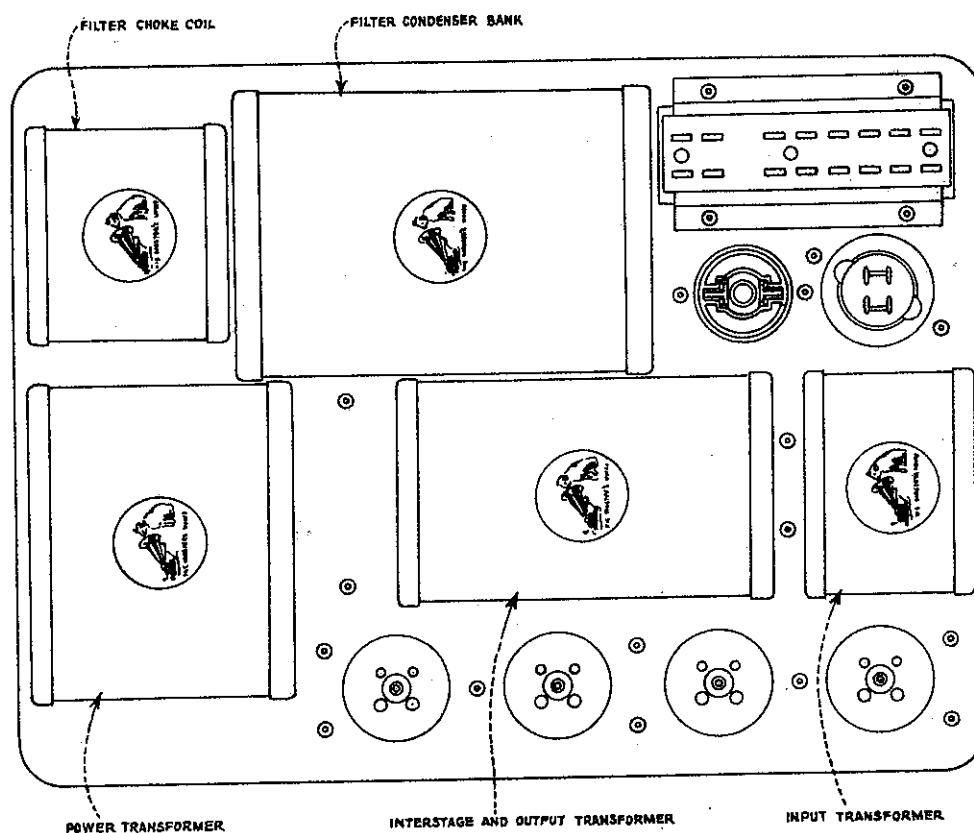


FIGURE 2 - TOP VIEW OF POWER AMPLIFIER UNIT, SHOWING PARTS

Adjusting Hum Controls. The two hum control potentiometers, shown in Figure 3, should be adjusted at the time of installation in the following manner:

- Place the transfer switch in the "record" position to the right.
- With a small screw driver turn the UX-226 hum control in the base of the power amplifier unit slightly in either direction as required until the hum is minimum.
- Turn the transfer switch to the left to the "radio" position, turn the radio volume control to minimum, and adjust the UY-227 hum control near the UY-227 in the radio set until the hum is a minimum.

Adjusting Harmonic Modulator. The harmonic modulator or tone control in the bottom of the power amplifier controls emphasis on the bass section of the scale, increasing the bass and decreasing the high notes as the adjusting screw is turned to the right. Ordinarily, the control will not require any change in setting from that made in the factory. It may be desirable in some cases, however, to change the adjustment because of unusual room characteristics, a customer's preference for stronger bass, or to reduce record scratch and static. The control arm can be turned with a small screw driver.

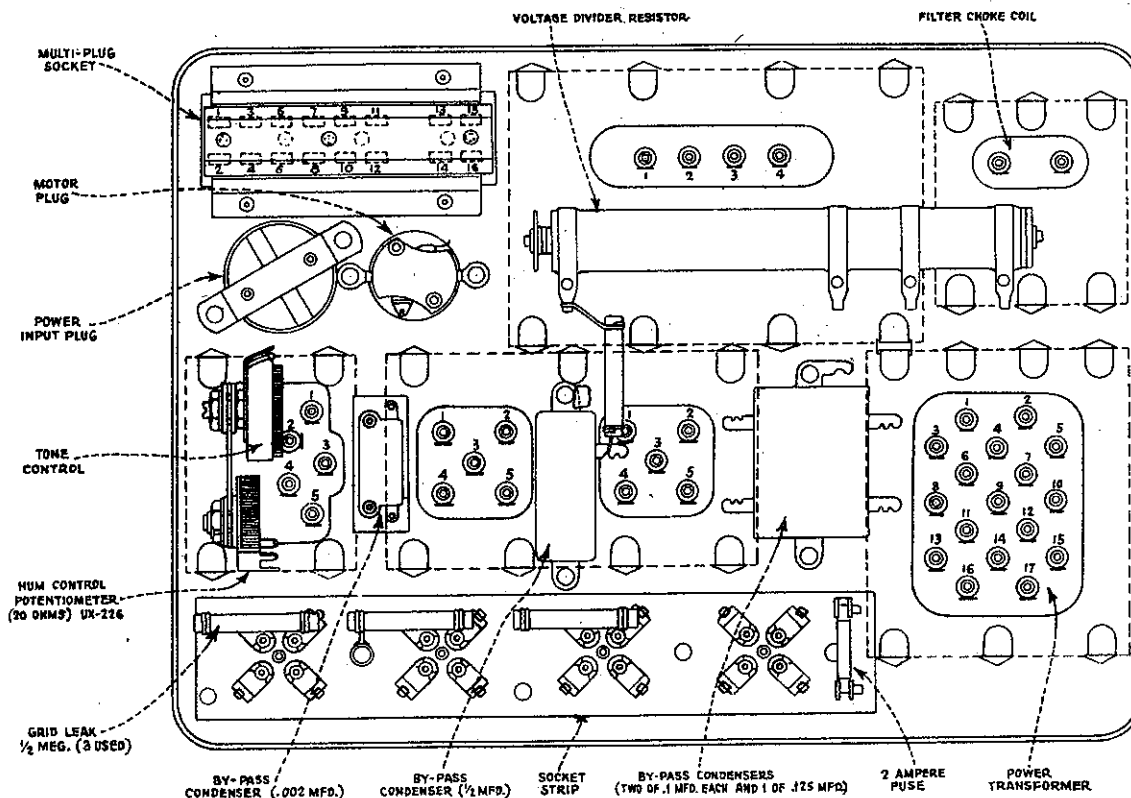


FIGURE 3- BOTTOM VIEW OF POWER AMPLIFIER UNIT, SHOWING PARTS.

GENERAL TESTS

Excessive Hum. This condition can be caused by:

- Improperly adjusted or faulty hum controls. Refer to the preceding paragraph on the subject, "Adjusting Hum Controls."
- Defective UX-280 or UY-227.
- Wire or terminal grounded to the frame, or open circuit in any of the various ground connections.
- Shorted condenser across UX-226 filament supply.
- Open or shorted center tap resistor across UX-226 filament supply.
- Shorted condenser across power line in power-amplifier unit.
- Shorted condenser in condenser bank of power-amplifier unit.

Howl. Microphonic howl can be traced to:

- Defective vacuum tube, particularly in the detector or audio stages.
- Improper neutralization. (See the section "Special Adjustments" on sheet 12)

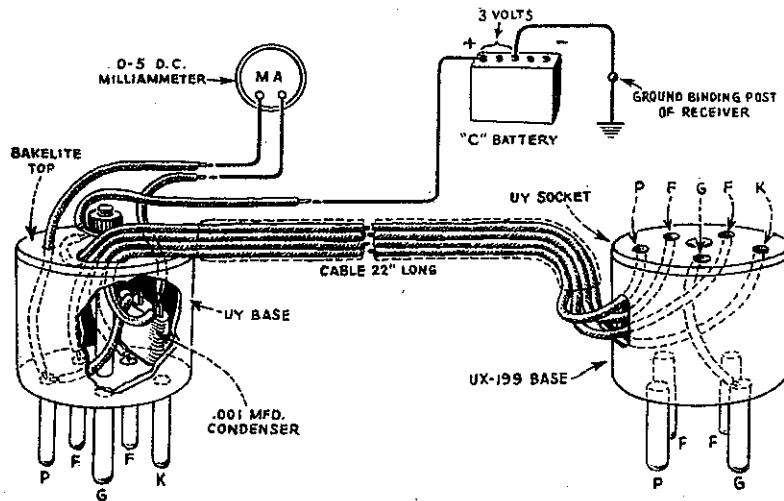


FIGURE 4 - CIRCUIT FOR TUBE VOLTMETER

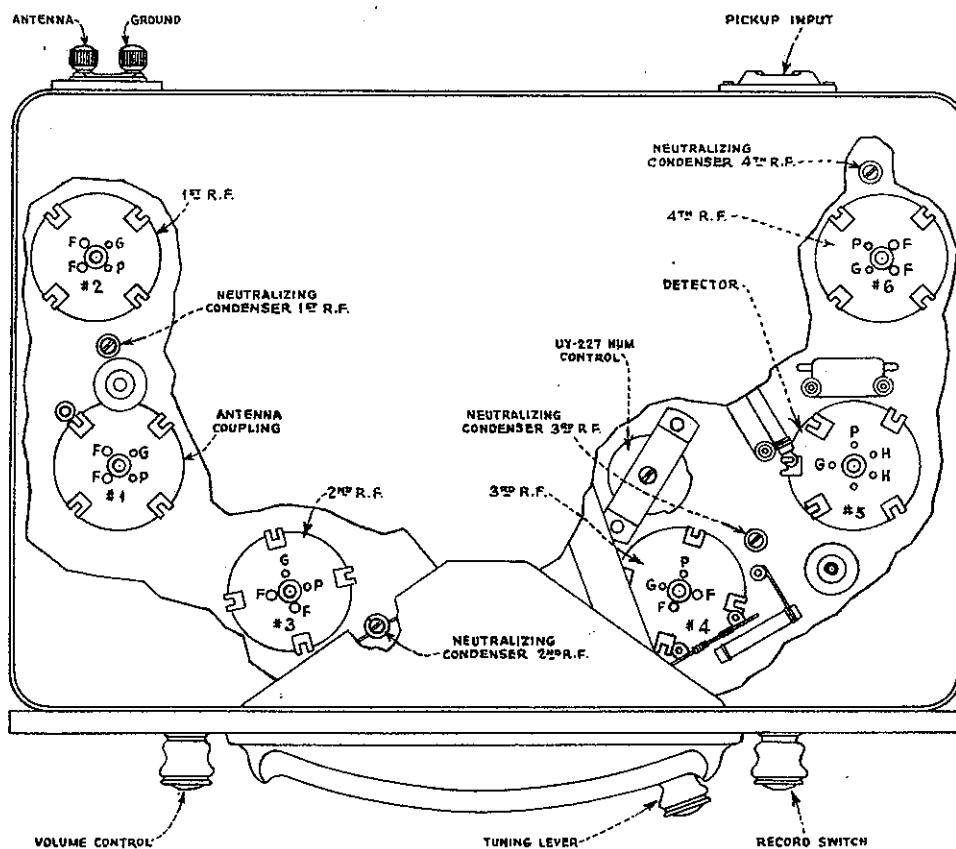


FIGURE 5 - TOP VIEW OF RADIO, SHOWING RADIOTRON SOCKETS

- c. Speaker not felt insulated from baffle. Remove speaker and arrange felt properly.
- d. Open condenser.
- e. Loose metal parts such as shielding, screws, etc., or improperly centered cone may set up a howl or mechanical rattle. (See the subject "Special Adjustments" on sheet 12 for method of centering the cone.)

Distorted Reproduction. Distortion may be caused by any of the following:

- a. Low emission vacuum tube, particularly in the detector or in the power supply unit. For best reproduction the plate currents of the two UX-245 should balance within 2 milliamperes.
- b. Operation with volume control advanced too far on powerful local stations, causing overloading of the detector.
- c. Incorrect setting of the tone control in the base of the power-amplifier.
- d. Improper neutralization.
- e. Cone in speaker unit improperly centered.

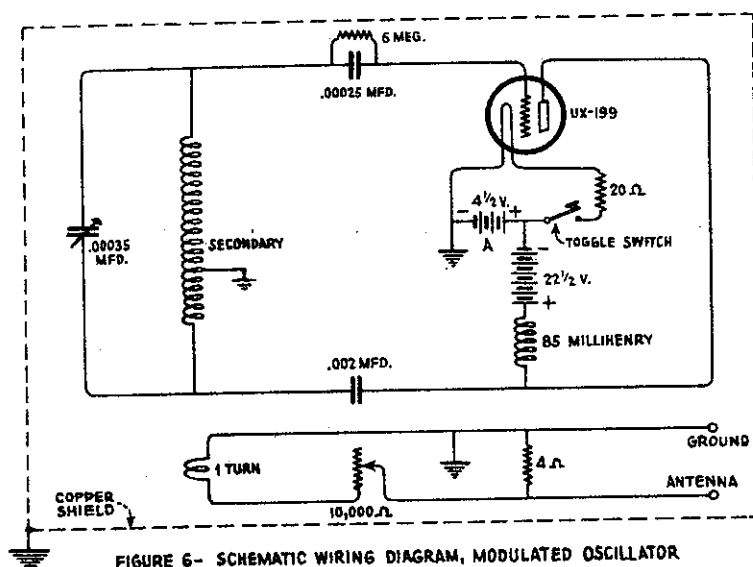


FIGURE 6- SCHEMATIC WIRING DIAGRAM, MODULATED OSCILLATOR

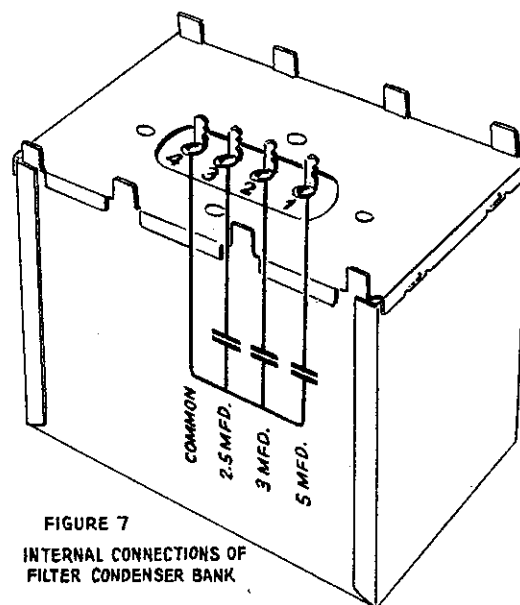


FIGURE 7
INTERNAL CONNECTIONS OF
FILTER CONDENSER BANK

Noisy Reproduction. Station carrier noise, static, and power line disturbance should not be confused with noise which is set up within the receiver. This latter condition may be caused by any one of the following:

- a. Volume Control. Dirt or corrosion on the resistance wire or contact arms of the volume control will produce noise when the control is operated. This condition can usually be corrected by rubbing the parts lightly with very fine sandpaper and then cleaning with gasoline.
- b. Shorted Tuning Condenser. If the plates of one or more of the tuning condensers are shorted, noise will be produced when the tuning lever is operated. If such a condition is found, the faulty condenser should be replaced.
- c. Intermittent short or open circuit in any of the various soldered connections or in power switch.
- d. High resistance grid leak. Any of the grid leaks which have developed

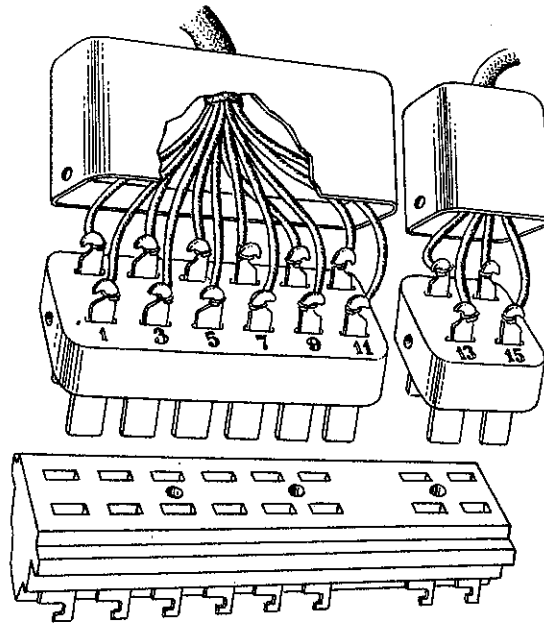


FIGURE 8 - MULTI PLUG TERMINALS

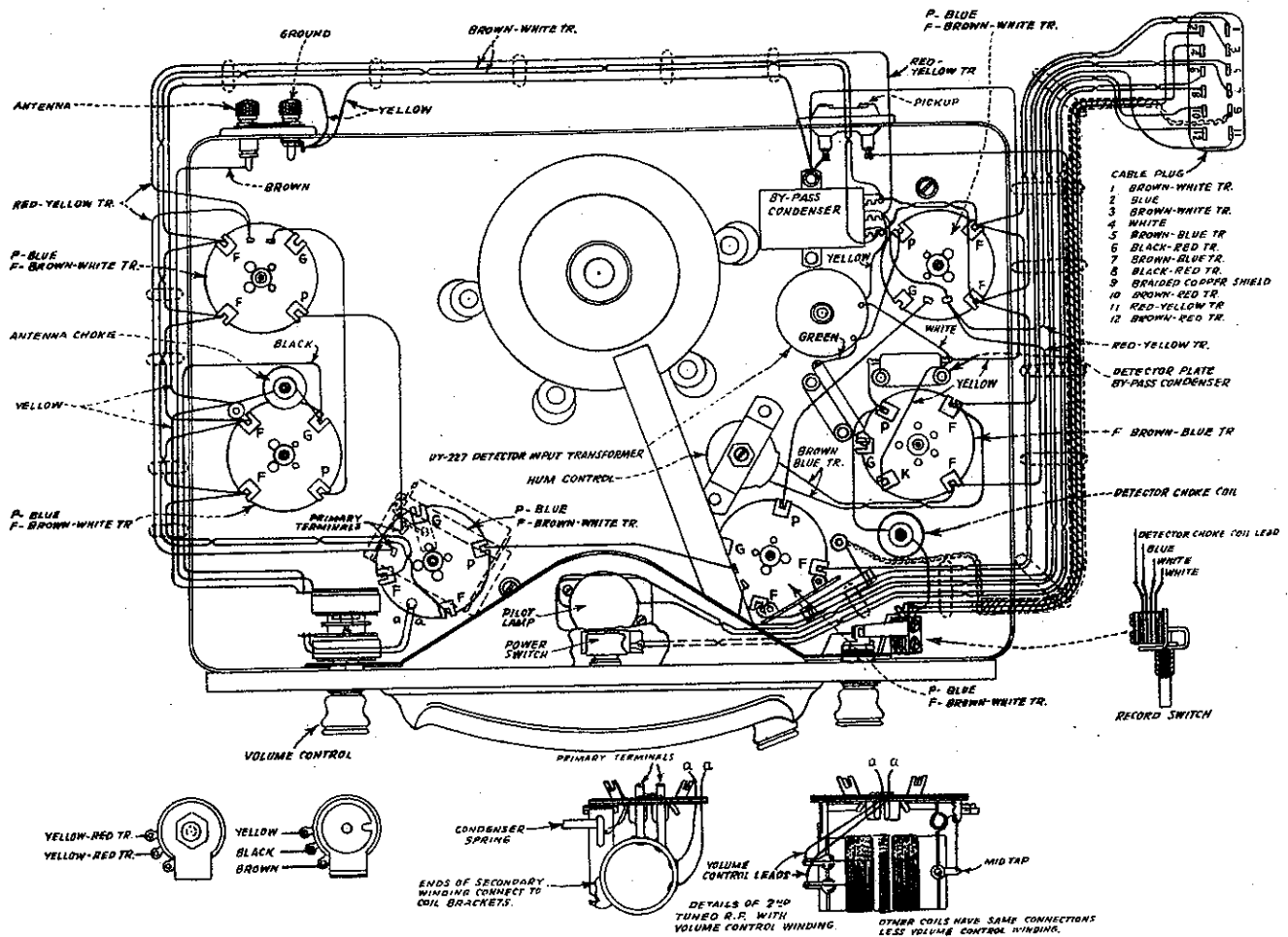
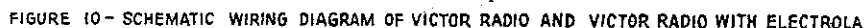


FIGURE 9 - TOP VIEW OF RADIO, SHOWING WIRING BETWEEN TERMINALS

e. Faulty power or audio transformer will also produce this same type noise.

- a. Faulty antenna, characterized by weak reception, intermittent reception, or grating noise. Examine the antenna for poor contact at the lead-in connection to the radio set, poor soldered connections, grounded or partially grounded lightning arrester, or contact with surrounding objects.
- b. Faulty ground, characterized by weak reception, intermittent reception, grating noise, or oscillation. Examine the ground wire for poor contact at the ground binding post connection of the radio set, poor soldered connections, corroded connection at ground clamp.
- c. Low power line voltage. Test power outlet with a-c voltmeter. The voltage should be between 105 and 125 volts for radio instruments, and between 105 and 120 volts for instruments with Electrola.
- d. Defective tube in any of the various sockets.
- e. Defect in radio set or power amplifier.



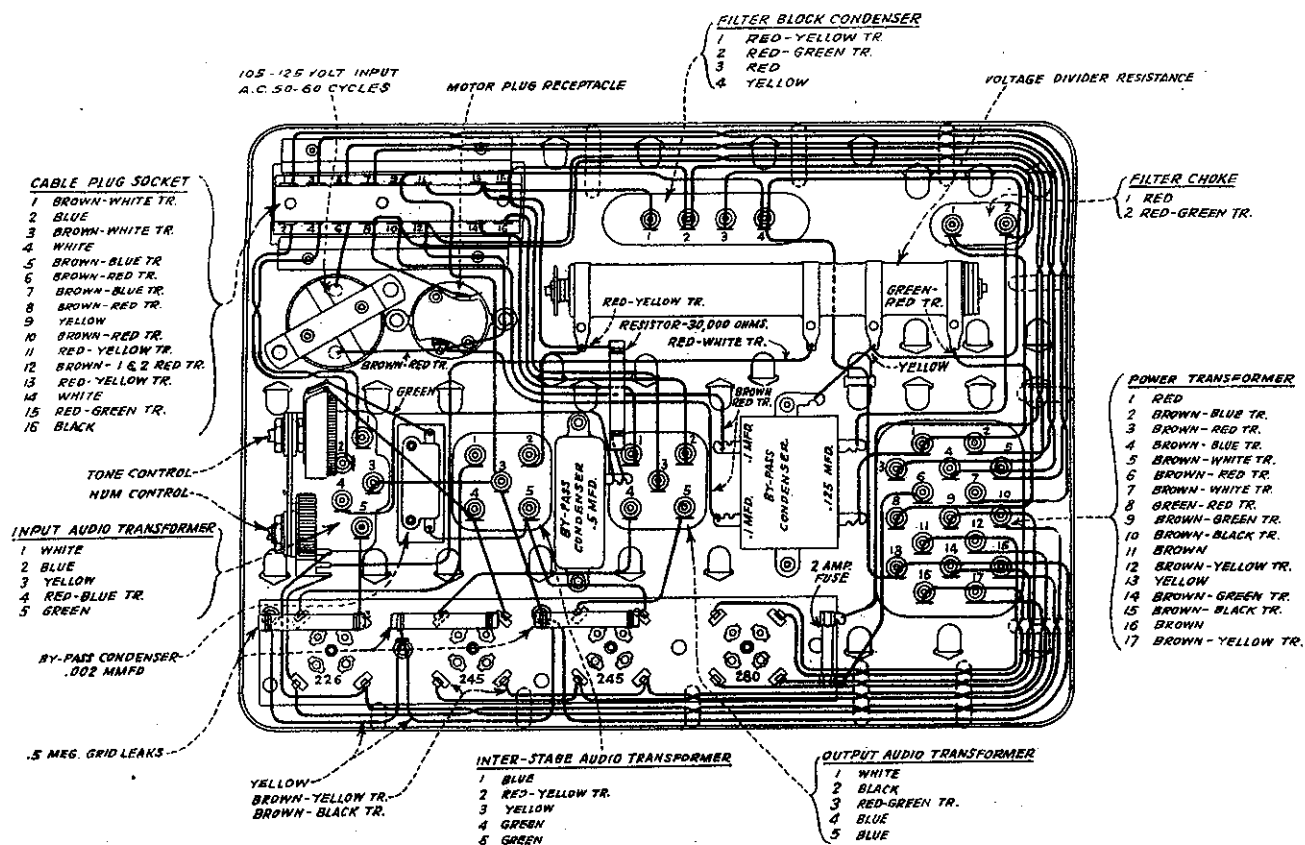


FIGURE 11- BOTTOM VIEW OF AMPLIFIER, SHOWING WIRING BETWEEN TERMINALS.

- f. Improper neutralization. This condition is characterized by a tendency of the set to oscillate.
- g. Improper alignment of tuning condensers.

Color Scheme. Refer to Figure 8. All of the connecting wires are covered with colored material so that they may be easily identified. They are as follows:

1. Brown-white tracer—UX-226 Filament
2. Blue—Transfer Switch
3. Brown-white tracer—UX-226 Filament
4. White—Transfer Switch
5. Brown-blue tracer—UY-227 Filament
6. Black-red tracer—Power Switch
7. Brown-blue tracer—UY-227 Filament
8. Black-red tracer—Power Switch
9. Braided Copper Shield—Ground
10. Brown-red tracer—Pilot
11. Red-yellow tracer—B UX-226
12. Brown-red tracer—Pilot Lamp
13. Red-yellow tracer—Field
14. White—Voice Coil
15. Red-green tracer—Field
16. Black—Voice Coil

Lack of Reproduction—Preliminary Tests. After it has been definitely determined that the trouble is not due to a faulty tube, antenna or ground, place the instrument in operation with the transfer switch in the "record" position. Note that all tubes are lighted, and that all cables are connected. In the combination models, play a record in the usual manner with the volume control advanced to maximum. On the radio models without Electrola, connect two wires to the terminals of a dry cell or to the 1.5 volt terminals of a "C" battery. Touch these wires across the two pin jack terminals marked "Phono," and note any click in the reproducer when this is done. If the record reproduction is correct, or if there is a noticeable click when the pickup pin jack terminals are tested in this manner, the trouble must lie in the radio set, and reference should be made to subject "Lack of Reproduction—Radio," following. If there is no record reproduction, then the trouble lies in the loudspeaker or power amplifier unit. It is recommended that a tube voltmeter, such as shown in Figure 4, and a Weston or Jewell test box be used for isolating trouble in the radio set.

SOCKET NO.	READING NO SIGNAL	READING WITH SIGNAL
1	.45 Milliamperes	.45 Milliamperes
2	.45 Milliamperes	.50 Milliamperes
3	.45 Milliamperes	.65 Milliamperes
4	.45 Milliamperes	1.80 Milliamperes
5	.45 Milliamperes	4.50 Milliamperes

Lack of Reproduction—Radio. After definitely determining that the trouble lies in the radio set, make the following tests with the tube voltmeter and test box:

- a. Place the transfer switch in the "radio" position.
- b. Remove the UY-227 detector tube, and insert the UY adapter in this socket.
- c. Remove the tube in socket No. 1, Figure 5, (coupling stage), place the UX adapter in this socket with the UX-227 in the socket of the adapter. Note the meter reading when all connections are made in accordance with Figure 4 and no station is being received.
- d. Place the UX adapter in socket No. 2, Figure 5, (1st r-f), and note a slight increased meter reading when a powerful local station is tuned in. Note: If such a broadcast signal is not available, a modulated oscillator, such as shown in Figure 6, can be used.
- e. Take readings in this same manner for sockets 3, 4 and 5. An additional increase, corresponding to an increase in signal strength, should be noted as readings are taken progressively, from one socket to another. In the first r-f socket which does not show any further increase in meter reading from that of the preceding socket will be found the source of trouble. These readings are entirely arbitrary and are intended to indicate gain per stage only. They will vary with different stations and with different milliammeters. The following is a typical set of readings obtained in this test.
- f. After locating the particular stage in which the trouble exists, test with the Weston or Jewell test box to determine the exact location of the faulty part or connection. The "Radio Voltage Tests" table lists the approximate voltage readings which should be obtained in

RADIO VOLTAGE TESTS

NOTE:—The following tests are to be made after determining that the trouble lies in the radio receiver and not the power amplifier unit as described in subject 6 above.

TEST	SOCKET NO.	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament	1	1.40 Volts A. C.	Poor socket contact, broken connection, shorted condenser, 10, Fig. 1.
	2	1.40 Volts A. C.	
	3	1.40 Volts A. C.	
	4	1.45 Volts A. C.	
	5	2.1 Volts A. C.	
	6	1.50 Volts A. C.	
Plate	1	105 Volts D. C.	Poor socket contact; broken connection; open 20 ohm resistor, 43, Fig. 1; open grid bias resistor, 44, Fig. 1; shorted condenser, 10, Fig. 1; open primary R. F. transformer; shorted neut. condenser open R. F. choke, 22, Fig. 1; faulty transfer switch; shorted .001 mfd. condenser, 15, Fig. 1.
	2	105 Volts D. C.	
	3	105 Volts D. C.	
	4	105 Volts D. C.	
	5	40 Volts D. C.	
	6	105 Volts D. C.	
Grid	1	9 Volts D. C.	Poor socket contact; broken connection; open 20 ohm resistor, 43, Fig. 1, across filament UX-226; open grid bias resistor, 44, Fig. 1; shorted condenser, 10, Fig. 1; open secondary R. F. transformer; shorted neut. condenser; faulty volume control and R. F. choke, 42 and 46, Fig. 1.
	2	9 Volts D. C.	
	3	9 Volts D. C.	
	4	9 Volts D. C.	
	5	0 Volts D. C.	
	6	9 Volts D. C.	

POWER AMPLIFIER VOLTAGE TESTS

TEST	SOCKET	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
Filament	UX-226	1.40 Volts A. C.	Poor socket contact; broken connection; defective UX-226 (ampl.) filament winding of power transformer, 57, Fig. 2.
	UX-245	2.2 Volts A. C.	Poor socket contact; broken connection; defective UX-245 filament winding of power transformer, 57, Fig. 2.
	UX-280	4.6 Volts A. C.	Poor socket contact; broken connection; defective UX-280 filament winding in power transformer, 57, Fig. 2.
Plate	UX-226	100 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open primary, interstage transformer, 58; defective voltage divider resistor, 60; shorted condenser in condenser bank, 56; open filter choke, 55; open or poor connection in UX-226 hum control 68, Figs. 2 and 3.
	UX-245	230 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open primary, output transformer, 58; open filter choke, 55; shorted condenser in condenser bank, 56; defective voltage divider resistor, 60, Figs. 2 and 3.
Grid	UX-226	6 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open secondary, input transformer, 59; defective voltage divider resistor, 60; poor or open contact in UX-226 hum control, 68; shorted condenser in condenser bank, 56, Figs. 2 and 3.
	UX-245	40 Volts D. C.	Low emission UX-280; poor socket contact; broken connection; open secondary, interstage transformer, 58; defective voltage divider resistor, 60; shorted condenser in condenser bank, 56, Figs. 2 and 3.

CABLE TERMINAL VOLTAGE TESTS

TEST BETWEEN TERMINALS	NORMAL VOLTAGE	LACK OF VOLTAGE OR ABNORMAL VOLTAGE INDICATES
1 and 3	1.70 Volts A. C.	Broken connection; defective UX-226 (radio) secondary winding of power transformer, 57, Fig. 3.
5 and 7	2.35 Volts A. C.	Broken connection; defective UY-227 secondary winding of power transformer, 57, Fig. 3.
2 and 9	39 Volts D. C.	Defective UX-280; broken connection; open radio primary, input transformer, 59, open filter choke; 61, defective voltage divider resistor, 60, shorted condenser, 56, Figs. 2 and 3.
9 and 11	105 Volts D. C.	Defective UX-280; broken connection; defective voltage divider resistor; open choke 61; shorted condenser, 56, Figs. 2 and 3.
13 and 15	185 Volts D. C.	Low emission UX-280; poor socket contact broken connection; open choke, 61, defective voltage divider, 60; shorted condenser in condenser bank, 56, Figs. 1 and 2.

each of the sockets at 110 volts power input and the possible location of the fault if these readings are not obtained. If the above tests do not locate the trouble the fault must then be caused by improper neutralization, defective volume control, or improper alignment or shorted plates of tuning condensers.

Lack of Reproduction—Speaker. If there is no reproduction on either radio or record, the trouble may be in the field or voice coil or in the cable leads of the speaker. Turn off the power switch, remove the speaker cable plug from the amplifier, test for voice coil continuity between terminals 14 and 16 (black and white), and for field continuity between terminals 13 and 15 (red with green tracer and red with yellow tracer.)

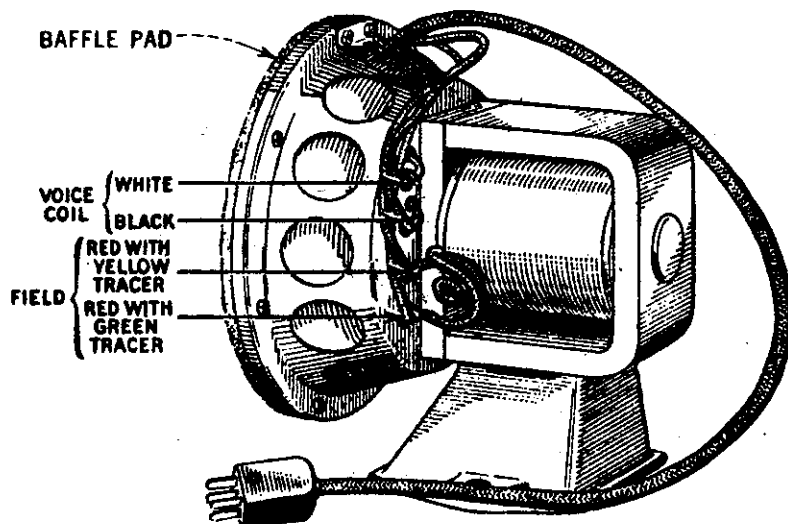


FIGURE 12- TERMINAL STRIP AND PARTS OF ELECTRO DYNAMIC REPRODUCER.

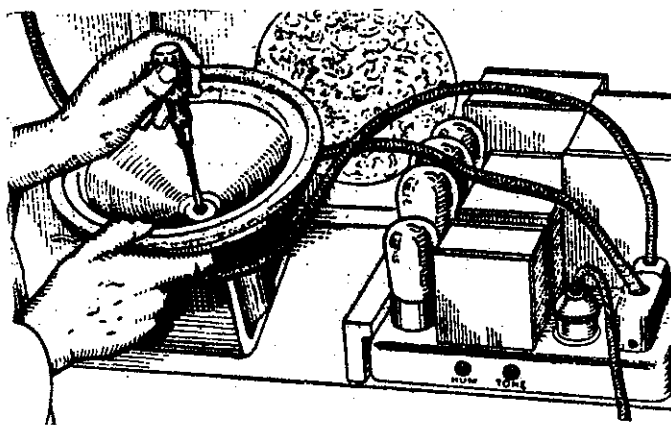


FIGURE 13- CENTERING CONE IN ELECTRO DYNAMIC REPRODUCER.

Lack of Reproduction—Power-Amplifier Unit. If the speaker has been found correct, the trouble must then lie in the power-amplifier unit, which should be tested in the following manner:

- a. Make the power-amplifier socket voltage tests with the Weston or Jewell test box. The "Power-Amplifier Voltage Tests" table lists the approximate voltage readings which should be obtained in each of the sockets at 110 volts power input, and the possible location of the fault if these readings are not obtained.
- b. If the trouble is not yet located, remove the screws in the metal cap over the terminal connections in the multi-plug, and make the Cable Terminal Voltage Tests with the plug in its socket of the amplifier, and the radio set in operation.
- c. Connect a 4.5 volt "C" battery in series with the voltmeter binding posts of the test box, and with the cable plugs disconnected from the amplifier test between the following multi-plug socket terminals for continuity.

SPECIAL ADJUSTMENTS

Neutralizing. Improper neutralization is characterized by oscillation and lack of sensitivity. First be sure that the instrument has a good ground

connection, since a poor ground will also cause oscillation. If oscillation still persists, the set should be neutralized in the following manner, using a dummy tube made by cutting off one of the filament prongs of a UX-226.

- a. Remove the four hex nuts which hold the plate.
- b. Tune in a powerful local station, preferably near the high frequency end of the scale. If such a signal is not available, a modulated oscillator, such as shown in Figure 6, can be used to supply the signal. If the oscillator is used, it should be placed near the radio set and approximately three feet of wire used as an antenna on the set.
- c. Remove the UX-226 from the first tuned r-f stage (socket No. 2, Figure 5) replace with the dummy UX-226, and adjust the corresponding neutralizing condenser to give minimum signal in the loudspeaker. The volume control may be set to obtain a signal loud enough for accurate neutralization, but not so loud as to cause the minimum to be blurred.

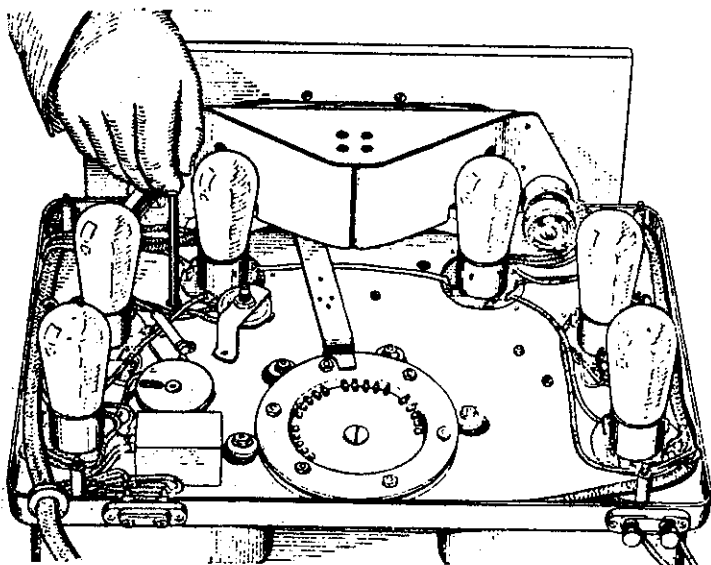


FIGURE 14 - METHOD OF NEUTRALIZING VICTOR RADIO

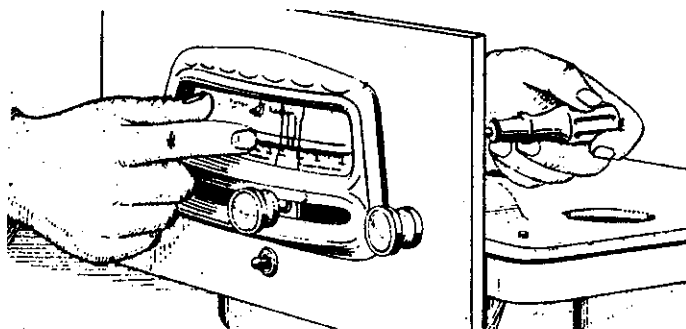


FIGURE 15 - REPLACING STATION SELECTOR DIAL

- d. Replace the UX-226 in socket No. 2, and repeat the procedure for sockets 3, 4 and 5, adjusting the corresponding neutralizing condenser in each case. After completing the neutralization in this manner, turn back the neutralizing condenser for socket No. 5 approximately 1/2 turn counter-clockwise. Note: the first UX-226, antenna coupling stage, is not neutralized. If the instrument continues to oscillate, it is probable that the condensers are out of alignment.

Centering Cone in Electro-Dynamic Reproducer. Improper centering of the fabric cone in the speaker is characterized by a noticeable rattle or buzz when the volume control is advanced. Such a rattle can sometimes be traced to faulty tubes in the detector or audio stages; this possibility should first be eliminated before attempting to center the cone. If the voice coil is improperly centered:

- a. Remove the large mounting screw in the base of the speaker and pull the unit away from the front of the cabinet.

- b. Place the instrument in operation with the transfer switch in the "record" position.
- c. Turn the UX-226 hum control all the way to the right or left to produce a loud 60 cycle hum.
- d. Loosen the center screw as shown in Figure 13, and then re-tighten it.
- e. Ordinarily, the cone should now be properly centered, which condition can be determined by the sound of the 60 cycle vibration. When the cone is improperly centered, a 60 cycle mechanical buzz will be heard as contrasted with a 60 cycle musical note when the coil is free and properly centered. In some cases it may be necessary to press the outer edge slightly while tightening the center screw in order to obtain proper voice coil clearance.
- f. Replace the speaker and re-adjust the UX-226 hum control.

Replacing Cloth Cone. Should it become necessary to replace the cloth cone because of an open voice coil or other defect, resort to the following:

- a. Unsolder the voice coil leads (black and white) from the terminals on the side of the frame.
- b. Carefully pull the felt insulating material away from the frame flange.

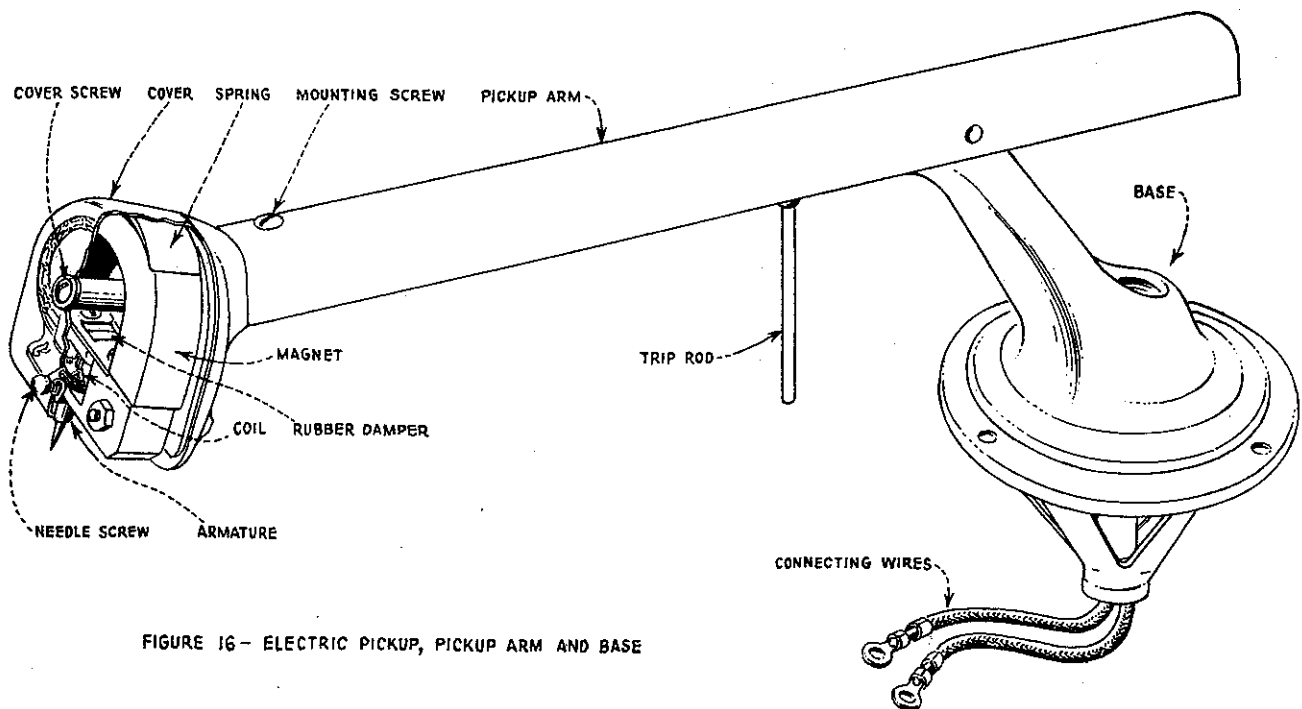


FIGURE 16 - ELECTRIC PICKUP, PICKUP ARM AND BASE

- c. Remove the eight screws which hold the retaining ring against the cone, and also remove the center screw and washer.
- d. Remove the retaining ring, and lift the old cone from the unit.
- e. Replace with the new cone and assemble in the reverse order from that given above, using Victor turntable cement to fasten the felt to the metal flange.
- f. Center the cone as previously described.

Replacing and Re-Adjusting Selector Scale. The following procedure should be used when replacing or shifting the selector scale.

- a. Disconnect the cable and wires to the radio set, and remove the set from the cabinet.
- b. Insert a screw driver through the holes in the back of the pilot lamp compartment as shown in Figure 16, and loosen the clamps on the old scale.
- c. Remove the old scale, and place the new one in position with the ends under the metal clamps.
- d. Before tightening the clamps, tune in a station of known broadcast frequency, and slide the scale slightly to the right or left until the number corresponding to the known frequency of the station is in line with the center mark of the celluloid indicator.
- e. Check this position on one or two other stations of known broadcast frequency.
- f. Holding the scale in the proper position, re-tighten the screws as shown in Figure 16.

Adjusting Electric Pickup. Faulty record reproduction with noticeable blasting, particularly on the bass notes, may be caused by worn records, needles or by improper centering of the pickup armature. If such a condition is traced to improper adjustment of the pickup, the armature should be centered in the following manner:

1. Remove the cover by taking out the needle screw and the cover screw, taking care that the magnet is not pulled away from the assembly.
2. Loosen both round head screws in the armature adjusting plate with a small screw driver.
3. Move the plate until the armature is properly centered between the pole pieces.
4. Hold the plate securely in its centered position, and re-tighten the screws.
5. When certain that the armature is properly centered, replace all parts of the pickup assembly.
6. While making adjustments to the pickup, the lubrication between the pickup arm and base should be checked. Victor motor grease should be placed on the bearing surface to insure free motion of the arm.

EXAMINATION - LESSON 44

1. (a) What are the advantages and disadvantages of a short antenna?
(b) Of a long antenna?
2. What does a rattle or buzz denote in a dynamic loudspeaker when the volume control is advanced?
3. How could you tell if this radio is improperly neutralized?
4. What is the most common cause of lack of reproduction?
5. What are the hum potentiometers used for?
6. If you wanted to install this receiver in a home that was wired to give voltage above 125 volts would you take any special precautions?
7. If you did not know the voltage in the home where the set is to be installed, how would you determine it?
8. If there was any doubt in your mind as to whether the house was wired for d-c. or a-c. what steps would you take to determine which supply was available?
9. What is the purpose of the harmonic modulator?
10. What is usually the cause of faulty record reproduction and what steps are taken to remedy this trouble?